CLAIMS

[001] A method for controlling a brushless DC motor (1) comprising the steps which are repeated cyclically: adjusting a desired speed of the motor (1) by varying an average terminal voltage of the motor; detecting the average power requirement (P) of the motor (1) and the lead angle (θ) between the rotor of the motor and the driving magnetic field, approximating the lead angle (θ) to a desired value given as a function of the speed (U) and the average power requirement (P).

[002] The method according to claim 1, characterised in that the desired value is that value of the lead angle (θ) which maximises the efficiency (η) of the motor (1) for the allocated values of the speed and average power requirement.

[003] The method according to claim 3, characterised in that the desired value of the lead angle is determined from a characteristic map (K) which specifies the lead angle with the highest efficiency for a plurality of operating points of the motor each defined by a speed and an average power requirement.

[004] The method according to claim 3, characterised in that the desired value of the lead angle for the actual speed and the average power requirement is obtained from the characteristic map by interpolation.

[005] The method according to any one of the preceding claims, characterised in that in step a) the average terminal power of the motor is varied by pulse width modulation.

[006] A control device for a brushless DC motor (1) comprising an AC/DC inverter (7) supplied by an intermediate direct voltage circuit (+, -) for feeding the DC motor (1), a pattern generator (3, 5, 6, 8-23) for controlling the switches (SU1, SU2, SV1, SV2, SW1, SW2) of the AC/DC inverter having a periodic switching signal pattern of variable frequency and phase, which has an input for a representative signal for an instantaneous phase position of the rotor of the DC motor (1), characterised in that the pattern generator has means (22, 21) for detecting the average current strength delivered by the AC/DC inverter and means (3, 5, 8-23) for adjusting a phase offset (lead angle) between the phase position of the rotor and the switching signal pattern depending on the detected average current strength and the speed of the motor (1).

[007] The control device according to claim 6, characterised in that this has means (21-23) for regulating an average terminal voltage of the motor (1) using a desired speed.

[008] The control device according to claim 6 or claim 7, characterised in that the means (3, 5, 8-23) for adjusting the phase offset comprise a PLL circuit (3, 5, 8-20) which can be locked to the frequency of the input signal representative for the phase position of the rotor.

[009] The control device according to claim 6, 7 or 8, characterised in that the means (3, 5, 8-23) for adjusting the phase offset comprise control means (21, 23) for predefining a target phase offset depending on the detected power and speed of the motor.

[010] The control device according to claim 9, characterised in that the control means (21, 23) comprise a storage device

(23) for the characteristic map of the motor (1), which specifies for combinations of motor speed and power, respectively one target phase offset which minimises the power requirement of the motor (1).

[011] The control device according to any one of claims 6 to 10, characterised in that the means (3, 5, 8-23) for adjusting the phase offset comprise means (21) for deriving the speed from the input signal representative for the phase position of the rotor.

[012] The control device according to any one of claims 6 to 11, characterised in that the means for adjusting the phase offset comprise a desired value transmitter (21, 23) for generating a representative signal for a desired value of the phase offset and a regulator (3, 5, 8-20) for matching the actual phase offset to the desired value using the representative signal, wherein the representative signal can have values above and below a representative value for a phase offset of 0°.

NEW CLAIMS

1. A method for controlling a brushless DC motor (1) comprising the iteratively repeated steps for adjusting the operating point of the motor (1) for a predetermined desired speed: adjusting the speed of the motor (1) to the value of the desired speed by varying an average terminal voltage of the motor (1), wherein the average terminal voltage of the motor (1) is determined by pulse width modulation; detecting the average power requirement (P) of the motor (1) and the lead angle (θ) between the rotor of the motor and the driving magnetic field; approximating the lead angle (θ) to a predetermined desired value as a function of the speed (U) and the average power requirement (P).

2. The method according to claim 1, characterised in that the desired value is that value of the lead angle (θ) which maximises the efficiency (η) of the motor (1) for the allocated values of the speed and average power requirement.

3. The method according to claim 3, characterised in that the desired value of the lead angle is determined from a characteristic map (K) which specifies the lead angle with the highest efficiency for a plurality of operating points of the motor each defined by a speed and an average power requirement.

4. The method according to claim 3, characterised in that the desired value of the lead angle for the actual speed and the average power requirement is obtained from the characteristic map by interpolation.

5. A control device for a brushless DC motor (1) comprising an AC/DC inverter (7) supplied by an intermediate direct voltage circuit (+, -) for feeding the DC motor (1), a pattern generator (3, 5, 6, 8-23) for controlling the switches (SU1, SU2, SV1, SV2, SW1, SW2) of the AC/DC inverter having a periodic switching signal pattern of variable frequency and phase, which has an input for a representative signal for an instantaneous phase position of the rotor of the DC motor (1), characterised in that the pattern generator has means (22, 21) for detecting the average current strength delivered by the AC/DC inverter and means (3, 5, 8-23) for adjusting a lead angle between the phase position of the rotor and the switching signal pattern depending on the detected average current strength and the speed of the motor (1), that the control device has means (21-23) for regulating an average terminal voltage of the motor (1) using a desired speed, and that the control device is designed to carry out the method according to any one of claims 1 to 4.

6. The control device according to claim 5, characterised in that the means (3, 5, 8-23) for adjusting the lead angle comprise a PLL circuit (3, 5, 8-20) which can be locked to the frequency of the input signal representative for the phase position of the rotor.

7. The control device according to claim 5 or claim 6, characterised in that the means (3, 5, 8-23) for adjusting the lead angle comprise control means (21, 23) for predefining a desired value of the lead angle depending on the detected power and speed of the motor.

8. The control device according to claim 7, characterised in that the control means (21, 23) comprise a storage device (23) for the characteristic map of the motor (1), which

specifies for combinations of motor speed and power, respectively one desired value of the lead angle which minimises the power requirement of the motor (1).

9. The control device according to any one of claims 5 to 8, characterised in that the means (3, 5, 8-23) for adjusting the lead angle comprise means (21) for deriving the speed from the input signal representative for the phase position of the rotor.

10. The control device according to any one of claims 5 to 9, characterised in that the means for adjusting the lead angle comprise a desired value transmitter (21, 23) for generating a representative signal for a desired value of the lead angle and a regulator (3, 5, 8-20) for matching the actual lead angle to the desired value using the representative signal, wherein the representative signal can have values above and below a representative value for a lead angle of 0°.